PAPER TAPE NO. 59310-16001

DIAGNOSTIC

FOR

HP 59310A/B INTERFACE BUS INTERFACE

reference manual

HEWLETT **hp** *PACKARD*

CONTENTS

ILLUSTRATIONS

TABLES

INTRODUCTION

1-1.   GENERAL

The 59310A/B Interface Bus Interface Diagnostic will test any combination of hardware from one 59310A/B Interface or two 59310A/B Interfaces with or without cabling (including any combination of 10631A, 10631B and/or 10631C). The interface(s) may be configured to any valid select code, MYADDR and SRQID.

A Troubleshooting Module is included to aid the operator in troubleshooting either a 59310 or any IB device using a 59310 as the system controller. If an error halt is encountered while running the diagnostic, the operator must be familiar with Table 3-1 which contains information on the meaning of data either reported on the console and/or in the A and B registers.

Section 3-3 which covers the Troubleshooting Module, assumes the operator is totally familiar with the control and communication operation of the 59310 and the HP-IB structure.

1-2.   REQUIRED HARDWARE

The following hardware is required to test the 59310 Interface.

a.   A HP 2100 series computer with a minimum 4K of memory.

b.   An absolute binary loading device (used only to load the Diagnostic).

c.   A console device (optional for message reporting).

d.   DMA or DCPC (optional but highly recommended).

e.   Any of the following hardware configurations:

  (1)   One 59310 interface with or without cabling.

  (2)   Two 59310 interfaces with or without cabling (if cabling is attached it should not exceed 20 meters).

1-3.   REQUIRED SOFTWARE

The following software is required to test the 59310 Interface:

a.   Diagnostic Configurator Product No. HP 24296A for equipment configuration and as a console driver. The product includes:

Binary Object Tape	Part No. 24296-60001
Manual	Part No. 02100-90157

b. HP 59310 Interface Bus Interface Diagnostic
    Binary Object Tape   Part No. 59310-16001
    Manual of Diagnostic Part No. 59310-90061

c. HP 59310 Bus Input/Output Interface Kit
    Manual   Part No. 59310-90007

The Diagnostic Serial Number of this diagnostic is 103022 and resides in Address 126.

1-4. DIAGNOSTIC LIMITATIONS

The diagnostic will not test

* The ability of the 59310 to propagate or generate priority-low (PRL).

* The ability to transmit data over the HP-IB at a rate of approaching one megabyte per second.

The cable test executed in the diagnostic, if selected, is valid only when two 59310 interfaces with different MYADDR settings are under test. However, any cabling attached to the 59310 interface(s) will be tested for shorts between wires because of the nature of the diagnostic itself. Also, there can be no device attached to the cabling during execution of the main tests and cable tests. The devices are attached only during execution of the Troubleshooting Module section.

If DMA (DCPC) is not installed, a relatively large section of the interface logic cannot be tested. It is therefore highly recommended that this option be installed!

1-5.   GLOSSARY OF TERMS

A glossary of terms is contained in table 1-1.

Table 1-1. Glossary of Terms

ATN	- ATTENTION
CATN	- CLEAR ATN
CG3MC	- CLEAR GROUP 3 MODE CONTROL
	(BITS 15-7 OF CONTROL WORD= 000000001 BINARY
CLCCF	- CLC IBI,C
CLRINTFLG	- CLEAR INTERRUPT FLAGS ISSUED BY CLC IBI,C
CRS	- CONTROL RESET TO I-O (GENERATED BY A CLC0,C)
DAC	- DATA ACCEPTED
DAV	- DATA VALID
DMAOUTREQFLG	- A CONDITION SET BY AN INITF.
DMARWSEL	- A GROUP 3 MODE CONTROL FOR INPUT OR OUTPUT DMA.
	DMARWSEL IMPLIES AN INPUT DMA REQUEST.
EOI	- END OR IDENTIFY
EOR	- END OF RECORD
EORFLGEN	- ENABLE FLAG DETECTION OF EOR.
GENSRQ	- ENABLE GENERATION OF SRQFLG.
IB	- INTERFACE BUS
IBI	- INTERFACE BUS INTERFACE CARD
IEN	- INTERRUPT ENABLE
IFC	- INTERFACE CLEAR
IFCFLG	- IFC FLAG
IFCOS	- IFC ONE-SHOT
INITF	- INITIALIZE FLAGS COMMAND
IRL	- INPUT REGISTER LOADED.
IRLFLGEN	- ENABLE FLAG DETECTION OF IRL.
MYADDR	- IB ADDRESS ASSIGNED TO THE INTERFACE.
NDMAOUTREQFLG	- A CONDITION SET BY A CLF IBI.
NDMARWSEL	- IMPLIES AN OUTPUT DMA REQUEST.
OBR	- OUTPUT BYTE REGISTER
OBRL	- OUTPUT BYTE REGISTER LOADED.
ORA(FLG)	- OUTPUT REGISTER ACCEPTED (FLAG).
ORAFLGEN	- ENABLE FLAG DETECTION OF ORA.
OWRL	- OUTPUT WORD REGISTER LOADED.
PACKEN	- PACK ENABLE CONTROL MODE FOR WORD TRANSFERS.
PPLEX	- PARALLEL POLL MODE ENABLE.
PPPID	- PARALLEL POLL MODE IDENTIFICATION.
PPREQ	- PARALLEL POLL MODE REQUEST.
REN	- REMOTE ENABLE.
RFD	- READY FOR DATA.
SINPD	- SET INPUT DATA COMMAND.
SKF	- SKIP FLAG TO I-O
SPM(FLG)	- SERIAL POLL MODE (FLAG).
SRQFLG	- SERVICE REQUEST FLAG (NOT TO BE CONFUSED WITH SRQ
	WITH SIGNALS DMA).
SRQFLGEN	- ENABLE FLAG DETECTION OF SRQFLG.
SRQID	- SERVICE REQUEST IDENTIFICATION.

2-1. ORGANIZATION

The diagnostic is separated into four main sections:

Configuration — which allows the operator to enter the select code, MYADDR and service request identification.

Main Test Area — which verifies proper operation of the 59310 interface(s) and that no shorts exist in any connected cabling (see Diagnostic Limitations).

Cable Test Area — which is executed if selected and only if two 59310 interfaces are under test. This section will verify that there are no open signal lines in the cabling.

Troubleshooting Module — which allows the operator to control and monitor the state of a 59310 interface and/or the HP-IB.

The operator may control error reporting and program execution via the switch register. (See table 3-4 for the available Switch Register settings or program options.)

3-1. OPERATING PROCEDURE

A flowchart of the diagnostic operating procedure is provided in figure 3-1. The IBI must not be connected to any devices during diagnostic execution.

3-2. DIAGNOSTIC EXECUTION

The configuration area of the diagnostic will enable the operator to enter the Select Code(s), MYADDR(s) and SRQ ID(s) (These values may be any valid value as defined in the BUS INPUT/OUTPUT INTERFACE KIT 59310A Manual (Part No. 59310-90007).

Next the main diagnostic area is entered which totally tests the first 59310 interface (designated during configuration) with certain Diagnostic Limitations. (Refer to paragraph 1-4.) Upon completion of the first IBI test a second pass of the main diagnostic is made to test the second IBI if it was designated during configuration.

Upon completion of the main diagnostic area, a test of Switch Register bit 0 is made to determine if the operator wants to execute the cable test. If Bit 0 is set (two IBIs must be under test or the diagnostic will halt with an error), a continuity test is executed on all signal lines in the cabling (a shorted cable is detected in the main diagnostic).

If Switch Register bit 1 or 2 is set, the diagnostic will enter the Troubleshooting Module:

1) before diagnostic execution but after configuration (if set when starting at address 100 or 2000),
2) after an error halt sequence is finished or
3) at the end of a diagnostic pass.

If the operator sets Switch Register bit 2 it overrides any setting of bit 1 and it indicates he wants to use the second IBI as system controller. If Switch Register bit 1 is set (and not bit 2) the first IBI will be used as the system controller. A further discussion of the Troubleshooting Module will be presented in paragraph 3-3.

If switch register bit 3 is set, it indicates the IBI(s) under test is a 59310B, part no. 59310-60101, exclusively. (The 59310A does not have Parallel Poll interrupt request logic.)

The only other exception to the normal Switch Register settings or program options is when Switch Register Bit 10 is set to suppress non-error messages. This option is overridden in the Troubleshooting Module where the only means of communication is through the console.

3-3. TROUBLESHOOTING MODULE

This section was added to enable the operator, via the console, to communicate with an IBI in order to: 1) diagnose the IBI or 2) diagnose a device or devices on the IB.
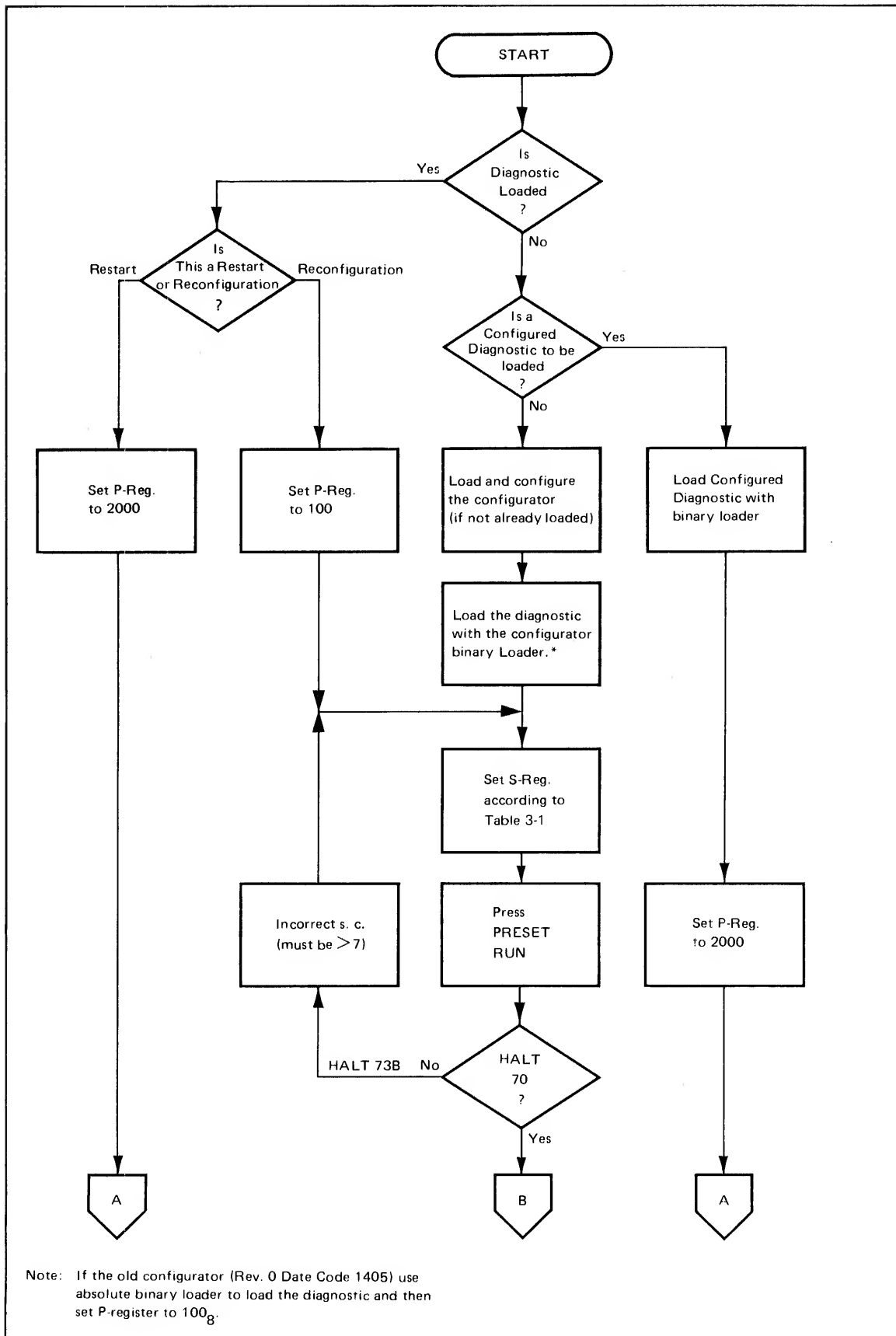
Figure 3-1. Operating Procedure Flowchart (Sheet 1 of 2)

```
          ( B )                                    ( A )
            │                                        │
            ▼                                        ▼
   ┌─────────────────┐                     ┌─────────────────────┐
   │  Set S-Reg.     │                     │ Load S-register with│
   │  according to   │                     │ desired options per │
   │  Table 3-2      │                     │ table 3-4.          │
   └─────────────────┘                     └─────────────────────┘
            │                                        │
            ▼                                        ▼
   ┌─────────────────┐                     ╱─────────────────────╲
   │  Press          │                    ╱ Press PRESET          ╲         ┌──────────────┐
   │  PRESET         │                    │ (EXT, INTL),           │         │ Diagnostic is│
   │  RUN            │                    ╲ RUN.                  ╱──────────│ in execution │
   └─────────────────┘                     ╲─────────────────────╱          └──────────────┘
            │                                        │
            ▼                                        │
   ┌─────────────────┐                               ▼
   │  HALT 71        │      ┌──────────────┐      ◇─────────◇                ┌──────────────────┐
   └─────────────────┘      │ Consult Error│  No ╱   Halt    ╲               │ End of Diagnostic│
            │               │ and Message  │◄────  102077₈    ────────────── │                  │
            ▼               │ table 3-5.   │      ╲    ?     ╱                └──────────────────┘
   ┌─────────────────┐      └──────────────┘       ◇───────◇
   │  Set S-Reg.     │              │                  │ Yes
   │  according to   │◄─────────────┘                  ▼
   │  Table 3-3      │                              ◇───────◇
   └─────────────────┘                        Yes ╱  Run    ╲
            │                               ◄───── another    ╲
            ▼                                      ╲  pass   ╱
   ┌─────────────────┐                              ◇───────◇
   │  Press          │                                  │ No
   │  PRESET         │                                  ▼
   │  RUN            │                             ╭───────────╮
   └─────────────────┘                             │   END     │
            │                                      ╰───────────╯
            ▼
   ┌─────────────────┐
   │  HALT 74        │
   └─────────────────┘
            │
            ▼
          ( A )
```
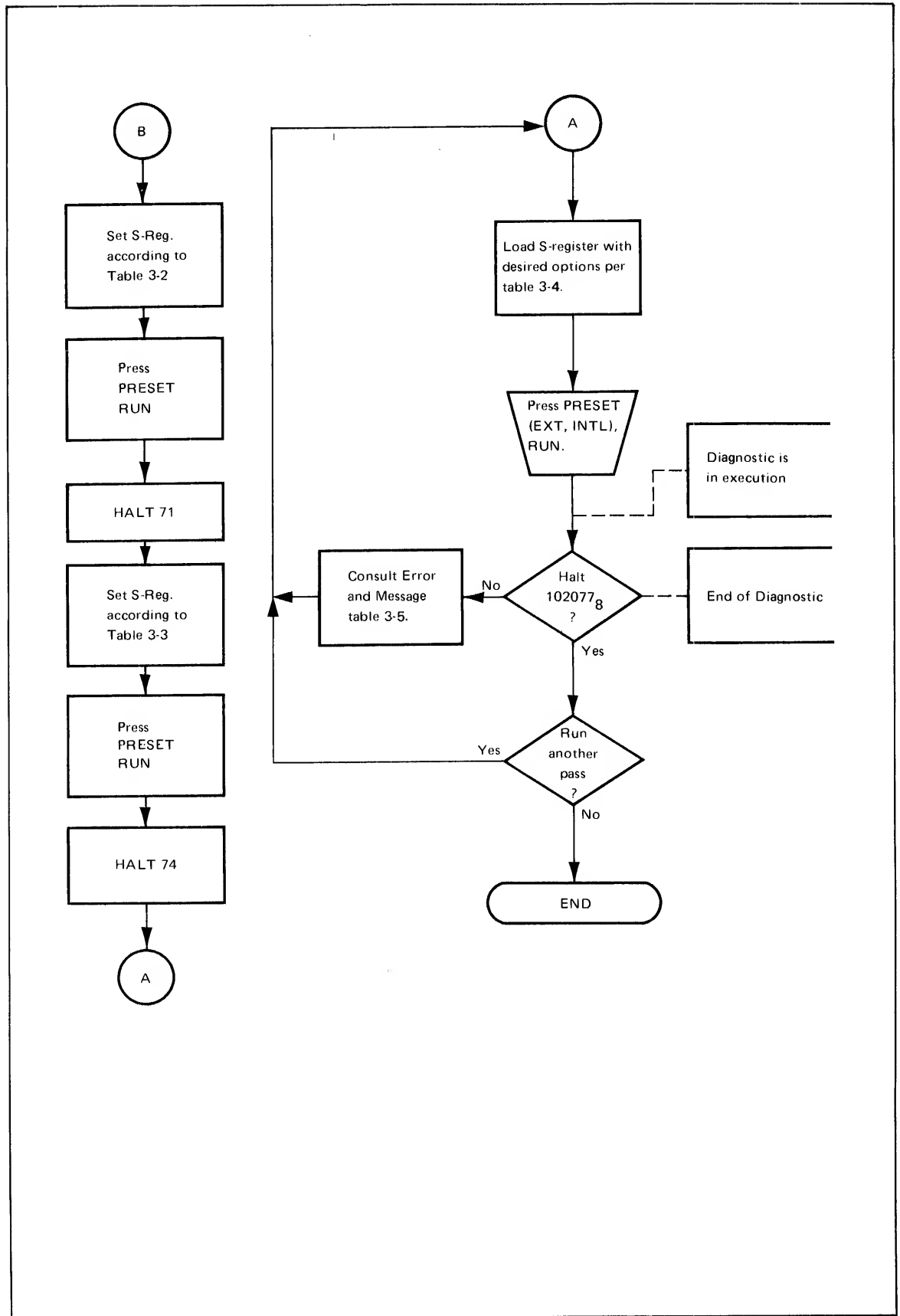
Figure 3-1. Operating Procedure Flowchart (Sheet 2 of 2)

When the Troubleshooting Module is entered, or when it has executed an operation, it will prompt the console with a colon (:). At this point the operator may utilize several commands:

A - Abort and exit to the end of the diagnostic.
S - Will automatically print the status of the IBI as six octal digits
I - Will automatically print the state of the input register of the IBI (six octal digits).
C - Allows the operator to input up to six octal numbers which will be interpreted and output to the IBI as a control word.
D - Allows the operator to input up to six octal numbers which will be interpreted and output to the IBI as a data word.

Any other non-command character input results in an "INPUT ERROR" message.

When using the above set of commands, the operator must be careful to distinguish between commands sent directly to the IBI and commands sent to a device on the bus. Any command sent to the bus must be preceded by C60 (ATN) or C40 (Data Mode), depending on the desired operation. The commands immediately following are prefixed by a "D".

For assistance in programming and inputting on a console, appendixes A through D provide the following:

a. Device Talk and Listen Addresses

b. Bus Commands

c. Control Word to IBI

d. Status Word Format (binary representation).

The C and D character inputs will 1) not recognize any non-octal character input (i.e., - :C4W5;68 would be interpreted as :C456), 2) require a CR-LF (carriage return line feed) for normal termination of an input string (the only exception being after six valid characters are entered an automatic return occurs) 3) only be aborted by an E character console input; a Rubout console input with CR-LF has no affect on the input string.

The following four examples should further clarify the module's operation and interaction with devices on the bus. Other programs can be derived from these examples and used as a troubleshooting aid for system problems. For all examples, remember to check that the hardware switch settings on the IBI and associated devices agree with the designated MYADDR listed in the program.

The first example will toggle the IBI Talk Mode.

:S022730	(The Talk Bit is Cleared)
:C110(CR-LF)	(Set Talk)
:S022770	(Talk Set-Status)
:C100(CR-LF)	(Clear Talk and Listen)
:S022630	(Talk and Listen Clear-Status)
:A	(Exit troubleshooting module)

The second example will force the IBI to talk to itself.

:C1(CR-LF)	(Set IFC)
:C60(CR-LF)	(Set ATN)
:D43(CR-LF)	(Listen Address) } MYADR 3
:D103(CR-LF)	(Talk Address) } (IBI switch setting)
:C40(CR-LF)	(Set Data Mode)
:D252(CR-LF)	(Output Pattern to IBI)
:I000252	(Get pattern from IBI)
:A	(Exit troubleshooting module)

The third and fourth examples exercise devices as well as the IBI. For these programming examples, equipment used (all HP types) is a 2100 Series Computer, 2600A System Console, 59310B IBI, 5340A Counter, 3490A Multimeter, 5150A Thermal Printer, 59400A RS232 TTY Interface, and a pulse generator (non-programmable). The parameters in the following table indicate the switch settings on the IBI and devices used to select the program addresses.

DEVICE	DEVICE MYADDR SWITCHES (A5-A1)	PROGRAM ADDRESSES	
		TALK	LISTEN
IBI	20	120	60
Printer	25	—	65
Counter	16	116	56
TTY	1	101	41
Multimeter	26	126	66

The third example sets up a counter to make a measurement, and the counter outputs readings to a printer and TTY. The pulse generator is set for a repetition rate of 100 kHz and is connected to the 1 megohm input port of the counter.

COMPUTER AND IBI TALKING TO COUNTER

C1	(Set IFC)
C100	(Disable IBI Talk and Listen)
C60	(Set ATN)
C3	(Set REN)
D137	(UNTALK bus command) } (Talk-Listen set up between IBI and devices.)
D120	(Talk address IBI)
D56	(Listen address counter)
C40	(Set Data Mode)
D117	
D61	
D123	} (Programming codes sent to counter to make measurement)
D112	
D114	
D110	
C1	(Set IFC)

COUNTER TALKING TO PRINTER AND TTY

C1	(Set IFC)
C100	(Disable IBI Talk and Listen)
C60	(Set ATN)
C3	(Set REN)
D137	(UNTALK bus command)
D77	(UNLISTEN bus command)
D116	(Talk address counter)
D65	(Listen address printer)
D41	(Listen address TTY)
C40	(Set Data Mode)

(Talk-Listen set up between devices.)

(Counter puts data on bus; handshaking sequences take over.)

C1	(Set IFC)
A	(Exit troubleshooting module)

The fourth example sets up a multimeter to take a measurement, and the multimeter outputs readings to a printer and TTY. A 121-ohm resistor is used for measurement.

COMPUTER AND IBI TALKING TO MULTIMETER

C1	(Set IFC)
C100	(Disable IBI Talk and Listen)
C60	(Set ATN)
C3	(Set REN)
D137	(UNTALK bus command)
D77	(UNLISTEN bus command)
D120	(Talk address IBI)
D66	(Listen address multimeter)

(Talk-Listen set up between IBI and devices.)

C40	(Set Data Mode)
D122	
D65	
D106	
D61	
D123	
D60	
D124	
D61	
D115	
D61	
D105	

(Programming codes sent to multimeter to make measurement.)

C1	(Set IFC)

MULTIMETER TALKING TO PRINTER AND TTY

C1	(Set IFC)	
C100	(Disable IBI Talk and Listen)	
C60	(Set ATN)	
C3	(Set REN)	
D137	(UNTALK bus command)	
D77	(UNLISTEN bus command)	(Talk-Listen set up between devices.)
D126	(Talk address multimeter)	
D65	(Listen address printer)	
D41	(Listen address TTY)	
C40	(Set Data Mode)	
•		
•		(Multimeter puts data on bus; handshaking sequences take over.)
•		
•		
C1	(Set IFC)	
A	(Exit troubleshooting module)	

3-4. ERROR INFORMATION AND HALT CODES

Error information and halt codes are contained in table 3-5. However, before interpreting error halts and/or messages, read the following information.

All messages printed on the console will indicate the failing select code (in cable test errors, the failing select code may not actually be at fault).

All messages printed on the console may be expanded where applicable, to include:

OUTPUT XXXXXX TO SC XX
INPUT XXXXXX FROM SC XX
EXPECTED INPUT = XXXXXX

The first string indicates the control word or data last output to the IBI; the second string indicates the status or data word input from the IBI and the third string indicates the expected status or data.

Most error messages will be followed by a coded error halt where the A-reg = input status and the B-reg = expected status.*

If no console is used, every error halt will be followed, after pressing run, by a secondary halt 106067 where the A-reg = the last control or data word output to the IBI and the B-reg = the failing select code.

*Exceptions are:

If the error halt was encountered during a data transmission the A&B registers represent input data and expected data respectively (these halts are marked with an asterisk in the following table).

If an error is caused by an incorrect IBI flag condition the A&B registers will be clear and are therefore irrelevant.

Table 3-1. IBI Select Code

SWITCH REGISTER BITS	MEANING
5-0	First IBI Select Code under test
11-6	Second IBI select code under test (If a second board is also being tested)
15-12	Not applicable

Table 3-2. IBI MYADDR Switch Setting

SWITCH REGISTER BITS	MEANING
5-0	First IBI MYADDR
11-6	Second IBI MYADDR (if applicable)
15-12	Not applicable
The MYADDR switches may be any position except octal 37 where all switches are open. The REN and IFC jumpers must be open and the Shield jumper may be open or closed. When using two interfaces the MYADDR can not be the same.	

Table 3-3. Service Request Identification Switch Setting

SWITCH REGISTER BITS	MEANING
7-0	First IBI Service Request Identification
15-8	Second IBI Service Request Identification (if applicable)
Only one bit per each interface can be used as a Service Request Identification.	

Table 3-4. Switch Register Control Settings

SWITCH REGISTER BIT	MEANING IF SET
15	Reserved
14	Suppress Error Halts
13	Reserved
12	Loop on diagnostic
11	Suppress Error Messages
10	Suppress Non-Error Messages (not valid for Troubleshooting Module)
9	Reserved
8	Suppress Preset Test
7-4	Reserved
3	Do Parallel Poll Request Test (59310B only)
2	Use second IBI select code in the Troubleshooting Module (if selected, this bit precludes and overrides setting switch register bit 1)
1	Use first IBI select code in the troubleshooting Module (if bit 2 clear)
0	Execute cable test

Table 3-5. Error Information and Halt Codes

HALT CODE	MESSAGE	COMMENTS
NONE	59310A INTERFACE DIAGNOSTIC	INTRODUCTORY MESSAGE ONLY.
102000	E000 SKF	CLCCF DID NOT CLEAR IBI FLAG FF OR ILLEGAL SKF ON SFS WITH FLAG CLEAR.
102001	E001 SKF	SRQFLG ACTIVE AND SRQFLGEN DID NOT SET IBI FLAGFF, OR ILLEGAL SKF ON SFC WITH FLAG SET, OR IFC SWITCH IN WRONG POSITION.
102002	E002 SKF	NO SKF ON SFS IBI WITH FLAG SET.
102003	E003 SKF	NO SKF ON SFC IBI WITH FLAG CLEAR.
102004	E004 IEN	IEN LOW (OR I/O INSTRUCTION) DID NOT HOLD OFF INTERRUPT.
102005	E005 SC XTALK	INSTRUCTION IN A-REG CAUSED FLAG TO CLEAR ON IBI.
102006	E006 CLC	IBI INTERRUPTED AFTER A CLC IBI.
102007	E007 INT	IBI DID NOT INTERRUPT.
102010	E010 IAK	IAK DID NOT DISABLE IBI AFTER AN INTERRUPT.
102011	E011 INITIAL STATUS FAILURE	PRESET STATUS OF IBI WAS INCORRECT.
102012	E012 ACTIVE	ACTIVE NOT LOW AFTER A CLEAR ACTIVE COMMAND.
102013	E013 ACTIVE	ACTIVE NOT HIGH AFTER A SET ACTIVE COMMAND.
102014	E014 REN	REN NOT HIGH AFTER REN COMMAND.
102015	E015 REN	REN NOT LOW AFTER A LOCAL COMMAND.
102016	E016 ATN	ATN NOT SET AFTER AN ATN COMMAND.
102017	E017 ATN	ATN NOT CLEAR AFTER A DATA MODE COMMAND.
102020	E020 ATN	ATN NOT SET AFTER AN ATN COMMAND.
102021	E021 ATN	ATN NOT LOW WITH ACTIVE CLEAR.
102022	E022 ATN	ATN NOT HIGH WITH ACTIVE SET.
102023	E023 ATN	ATN NOT CLEAR AFTER A DATA MODE COMMAND.
102024	E024 TALK	TALK NOT HIGH AFTER A SET TALK COMMAND.
102025	E025 TALK	TALK NOT LOW AFTER A CLEAR TALK COMMAND.
102026	E026 LISTEN	LISTEN NOT HIGH AFTER A SET LISTEN COMMAND.

Table 3-5. Error Information and Halt Codes (Continued)

HALT CODE	MESSAGE	COMMENTS
102027	E027 LISTEN	LISTEN NOT LOW AFTER A CLEAR LISTEN COMMAND.
102030	E030 IFC OS	ACTIVE WAS NOT HIGH AFTER AN IFC.
102031	EO31 IFC OS	IFC OS-DID NOT STAY TRIGGERED AFTER 40 MICROSECONDS.
102032	E032 IFC OS	IFC OS DID NOT CLEAR AFTER A ONE MILLISECOND DELAY.
102033	E033 REN OR IFC	EITHER REN WASN'T CLEARED OR IFC WASN'T SET BY CRS.
102034	E034 EOR	EOR FLAG STATUS LOW AFTER A SINPI WAS EXECUTED WITH ATN AND EOI HIGH.
102035	E035 EOR	EOR FLAG STATUS HIGH AFTER A SINPD WAS EXECUTED WITH EOI LOW.
102036	E036 EOR	CLRINTFLG DID NOT CLEAR EOR FLAG.
102037	E037 EOR	ATN CLEAR DID NOT DISABLE EOI TO EOR FLAG.
102040	E040 EOR	EOR FLAG STATUS HIGH AFTER A SINPD WAS EXECUTED WITH EOI LOW.
102041	E041 EOR	IFC DID NOT CLEAR EOI FF.
102042	E042 I-O FLAG	IBI FLAG SET AFTER A CLCCF.
102043	E043 I-O FLAG	IBI FLAG SET WITH EOR FLAG HIGH AND EORFLGEN LOW.
102044	E044 EOR FLAG	IBI FLAG NOT SET WITH EOR FLAG AND EORFLGEN HIGH.
102045	E045 EOR FLAG	CRS DID NOT CLEAR EORFLGEN.
102046	E046 EOR FLAG	CG3MC DID NOT CLEAR EORFLGEN.
102047	E047 EOR FLAG	IBI FLAG SET WITH EOR FLAG LOW AND EORFLGEN HIGH.
102050	E050 HANDSHAKE	IFC DID NOT FORCE RFD AND DAC HIGH AND DAV LOW.
102051	E051 HANDSHAKE	RFD FF HIGH AND LISTEN SET DID NOT FORCE RFD, DAC AND DAV LOW.
102052	E052 HANDSHAKE	RFD FF LOW AND LISTEN SET DID NOT FORCE DAC AND DAV LOW AND RFD HIGH.
102053	E053 HANDSHAKE	INITF DID NOT SET RFD FF.

Table 3-5. Information and Halt Codes (Continued)

HALT CODE	MESSAGE	COMMENTS
102054	E054 HANDSHAKE	EOR FLAG HIGH AND ATN AND RFD FF LOW DID NOT FORCE RFD, DAC AND DAV LOW.
102055	E055 HANDSHAKE	ATN AND EOI HIGH DID NOT FORCE DAV AND DAC LOW AND RFD HIGH.
102056	E056 HANDSHAKE	EOR FLAG CLEAR DID NOT FORCE DAV AND DAV AND DAC LOW AND RFD HIGH.
102057	E057 HANDSHAKE	RFD FF SET AND LISTEN CLEAR DID NOT FORCE RFD AND DAC HIGH AND DAV LOW.
102060	E060 HANDSHAKE	LISTEN AND ATN HIGH DID NOT FORCE DAC AND DAV LOW AND RFD HIGH.
102061	E061 ORA FLAG	INITF DID NOT FORCE ORA FLAG HIGH.
102062	E062 ORA FLAG	OWRL FF CLEAR DID NOT FORCE ORA FLAG LOW.
102063	E063 ORA FLAG	IBI FLAG ILLEGALLY SET BY ORA LOGIC.
102064	E064 ORA FLAG	ORAFLGEN AND ORA FLAG HIGH DID NOT SET THE IBI FLAG.
102065	E065 ORA FLAG	ORAFLGEN WAS NOT CLEARED BY CG3MC.
102066	E066 ORA FLAG	CRS DIDN'T CLEAR ORAFLGEN.
102067	E067 IRL FLAG	IRL FLAG STATUS LOW AFTER SINPD SHOULD HAVE CLOCKED IRL FF HIGH.
102070	NONE	TEST SELECT CODE(S) HAVE BEEN PROPERLY LOADED. SET S-REG 11-6=SECOND TEST SC MYADDR (IF APPLICABLE) 5-0 = FIRST TEST SC MYADDR. PRESS RUN.
102071	NONE	MYADDR TEST VALUES HAVE BEEN PROPERLY LOADED. SET S-REG 15-8=SECOND TEST SC MYADDR. PRESS RUN.
102071	NONE	MYADDR TEST VALUES HAVE BEEN PROPERLY LOADED. SET S-REG 15-8=SECOND TEST SC SRQID (IF APPLICABLE). 7-0 = FIRST TEST SC SRQID. PRESS RUN.
102074	NONE	HARDWARE CONFIGURATION INPUT COMPLETE. SELECT PROGRAM OPTIONS (SEE TABLE 1-1) AND PRESS RUN.
102073	NONE	IBI SELECT CODE INPUT ERROR. (SELECT CODE <10) ENTER PROPER VALUE AND PRESS RUN.
102077	PASS XXXXX	END OF TEST (A NUMBER OF PASSES COMPLETED).
103000	E100 IRL FLAG	IRL FF WAS NOT CLEARED BY A LIA IBI INSTRUCTION.

Table 3-5. Error Information and Halt Codes (Continued)

HALT CODE	MESSAGE	COMMENTS
103001	E101 IRL FLAG	SINPD DID NOT SET THE IRL FF.
103002	E102 IRL FLAG	LIA IBI INSTRUCTION AND SINPD DID NOT CLEAR THE IRL FF.
103003	E103 IRL FLAG	IBI FLAG ILLEGALLY SET BY IRL LOGIC.
103004	E104 IRL FLAG	IBI FLAG NOT SET WITH IRL FLAG AND IRLFLGEN HIGH.
103005	E105 IRLFLAG	CRS DIDN'T CLEAR IRLFLGEN.
103006	E106 IRLFLAG	CG3MC DIDN'T CLEAR IRLFLGEN.
103007	E107 SRQFLG	SRQFLG STATUS LOW WITH ACTIVE AND THE IFCFLG HIGH.
103010	E110 SRQFLG	SRQFLG STATUS HIGH WITH ACTIVE CLEAR AND THE IFCFLG HIGH.
103011	E111 SRQFLG	CG3MC DIDN'T CLEAR SRQ FLGEN.
103012	E112 SRQFLG	IBI FLAG LOW WITH SRQFLG AND SRQFLGEN HIGH.
103013	E113 SRQFLG	CRS DIDN'T CLEAR SRQFLGEN.
103014	E114 SRQFLG	SRQFLGEN ILLEGALLY SET WITH CONTROL WORD BIT 7 LOW.
103015	E115 SRQFLG	DATA OUTPUT TO IBI WAS INTERPRETED AS A CONTROL WORD.
103016	E116 SRQFLG	SRQFLGEN NOT SET BY CONTROL WORD OUTPUT.
103017	E117 SRQFLG	IBI FLAG ILLEGALLY SET WITH IFCFLG AND ACTIVE CLEAR.
103020	E120 SRQFLG	SRQFLG NOT HIGH WITH LISTEN AND RFD FF LLOW AND GENSRQEN HIGH.
103021	E121 SRQFLG	SRQFLG NOT LOW WITH TALK AND LISTEN SET.
103022	E122 SRQFLG	SRQFLG NOT LOW WITH GENSRQEN, RFD FF AND LISTEN LOW.
103023	E123 SRQFLG	SRQFLG NOT LOW WITH TALK, OBRLFLG AND GENSRQEN HIGH.
103024	E124 SRQFLG	CRS DID NOT GENSRQEN.
103025	E125 SRQFLG	GENSRQEN ILLEGALLY SET BY MODE CONTROL.

Table 3-5. Error Information and Halt Codes (Continued)

HALT CODE	MESSAGE	COMMENTS
103026	E126 SRQFLG	SRQFLG NOT LOW WITH TALK, OBRLFLG AND GENSRQEN HIGH.
103027	E127 SRQFLG	SRQFLG NOT HIGH WITH LISTEN AND RFDFF LOW AND GENSTRQEN HIGH.
103030	E130 SRQFLG	SRQFLG NOT HIGH WITH LISTEN AND RFDFF LOW AND GENSRQEN HIGH.
103031	E131 SRQFLG	SRQFLG NOT LOW WITH LISTEN LOW AND RFDFF AND GENSRQEN HIGH.
103032	E132 REN	REN STATUS LOW WITH REN FF HIGH AND SRQ ON THE IB LOW.
103033	E133 SRQFLG	SRQFLG NOT HIGH WITH TALK LOW AND GENSRQEN AND OBRLFLG HIGH.
103034	E134 SRQFLG	SRQFLG NOT LOW WITH OBRLFLG AND TALK LOW AND GENSTRQEN HIGH.
103035	E135 SRQFLG	SRQFLG NOT HIGH WITH TALK LOW AND GENSRQEN AND OBRLFLG HIGH.
103036	E136 SRQFLG	SRQFLG NOT LOW WITH TALK, GENSRQEN AND OBRLFLG HIGH.
103037	E137 SRQFLG	SRQFLG NOT LOW WITH TALK AND GENSRQEN LOW AND OBRLFLG HIGH.
103040	E140 SRQFLG	SRQFLG NOT HIGH WITH SPMFLG SET AND ACTIVE LOW.
103041	E141 SRQFLG	SRQFLG NOT LOW WITH SPMFLG CLEAR AND ACTIVE LOW.
103042	E142 SPM FLAG	DATA IN A REGISTER ILLEGALLY SET THE SPMFLG FF.
103043	E143 SPM FLAG	DATA=30(OCTAL) DID NOT SET THE SPMFLG FF.
103044	E044 SPM FLAG	DATA=31(OCTAL) DID NOT CLEAR THE SPMFLG FF.
103045	E145 SRQFLG	SRQFLG HIGH WITH ACTIVE AND SMPFLG FF HIGH.
103046	E146 PPPID	PPPID ENCODED INCORRECTLY.
103047	E147 PPPID	IFC DID NOT FORCE PPPID TO 11(OCTAL).
103050*	E150 BUS DATA	DATA ON IB IS NOT ALL ONES WITH DATA BUFFERS DISABLED.
103051*	E151 PPPID	PPPID ON IB DATA LINES WAS NOT EQUAL TO THE EXPECTED PPPID.

Table 3-5. Error Information and Halt Codes (Continued)

HALT CODE	MESSAGE	COMMENTS
103052	E152 MY ADDR	TALK AND/OR LISTEN WAS SET WITHOUT THE CONTROL BITS 5 AND 6.
103053	E153 MY ADDR	A TALK AND/OR LISTEN ADDRESS WAS DECODED WHICH DOESN'T EQUAL THE EXPECTED MYADDR.
103054	E154 MY ADDR	NO LISTEN ADDRESS WAS DECODED.
103055	E155 MY ADDR	NO TALK ADDRESS WAS DECODED.
103056	E156 LISTEN	LISTEN WAS NOT CLEARED BY IFC.
103057	E157 TALK	TALK WAS NOT CLEARED BY IFC.
103060	E160 TALK	TALK WAS NOT CLEARED BY UNTALK.
103061	E161 TALK	TALK ILLEGALLY SET WITH PROPER ADDRESS BUT NO DAV.
103062	E162 TALK	TALK ILLEGALLY CLEARED WITH PROPER ADDRESS BUT NO DAV.
103063	E163 LISTEN	LISTEN ILLEGALLY SET WITH PROPER ADDRESS BUT NO DAV.
103064	E164 LISTEN	LISTEN ILLEGALLY CLEARED WITH UNLISTEN ADDRESS BUT NO DAV.
103065*	E165 BUS DATA	DATA OUTPUT TO THE IB AND STROBED BY SINPD DID NOT COMPARE (8-BIT WORD ONLY).
103066*	E166 BUS DATA	DATA OUTPUT TO THE IB AND STROBED TWICE BY SINPD IN THE PACKEN MODE DID NOT COMPARE (16-BIT WORD).
103067*	E167 BUS DATA	PACKEN CLEAR DID NOT CLEAR INPUT REGISTER BITS 15-8.
106000	E200 ASCII MODE	AN ASCII MODE LOCAL COMMAND DID NOT EXECUTE.
106001	E201 ASCII MODE	ASCII MODE LOCAL ALLOWED TO EXECUTE ILLEGALLY WITH OBRL FF SET.
106002	E202 ASCII MODE	OBR BIT 5 DIDN'T DISALLOW AN ASCII MODE LOCAL COMMAND TO EXECUTE.
160003	E203 ASCII MODE	OBR BIT 6 DIDN'T DISALLOW AN ASCII MODE LOCAL COMMAND TO EXECUTE.
106004	E204 ASCII MODE	ASCII MODE CONTROL LOW DIDN'T DISALLOW AN ASCII MODE LOCAL COMMAND TO EXECUTE.
106005	E205 ASCII MODE	CRS DIDN'T CLEAR ASCII MODE CONTROL.

Table 3-5. Error Information and Halt Codes (Continued)

HALT CODE	MESSAGE	COMMENTS
106006	E206 ASCII MODE	DATA ON IB=12(OCTAL) DID NOT GENERATE AN ASCII MODE EOI OR HARDWARE EOR.
106007	E207 ASCII MODE	ASCII MODE LOW DID NOT HOLD OFF ASCII MODE EOI OR HARDWARE EOR.
106010	E210 ASCII MODE	ILLEGAL DECODE OF ASCII MODE EOI WITH DATA ON IB NOT EQUAL TO 12 (OCTAL) OR 33 (OCTAL).
106011	E211 EOR	ILLEGAL DECODE OF A HARDWARE EOR WITH DATA ON IB NOT EQUAL TO 12 (OCTAL) OR 33 (OCTAL).
106012	E212 EOR	ILLEGAL EOR GENERATED FROM IB DATA = 52 (OCTAL).
106013	E213 EOR	ILLEGAL EOR GENERATED FROM IB DATA= 112 (OCTAL).
106014	E214 ASCII MODE	DATA NOT EQUAL TO 33 (OCTAL) IN THE OBR GENERATED AN ILLEGAL ASCII MODE IFC.
106015	E215 ASCII MODE	OBR DATA= 33 (OCTAL) DID NOT TRIGGER AN ASCII MODE IFC.
106016	E216 ASCII MODE	OBR DATA#2 ILLEGALLY GENERATED AN ASCII MODE REMOTE.
106017	E217 ASCII MODE	OBR DATA= 2 DIDN'T GENERATE AN ASCII MODE REMOTE.
106020	E220 ASCII MODE	OBR DATA#3 ILLEGALLY GENERATED AN ASCII MODE LOCAL.
106021	E221 ASCII MODE	OBR DATA#16 (OCTAL) OR 33 (OCTAL) ILLEGALLY GENERATED AN ASCII MODE ATN.
106022	E222 ASCII MODE	OBR DATA= 16 (OCTAL) DIDN'T GENERATE AN ASCII MODE ATN.
106023	E022 ASCII MODE	OBR DATA#17 (OCTAL) ILLEGALLY GENERATED AN ASCII MODE CATN.
106024	E224 ASCII MODE	OBR DATA=17(OCTAL) DIDN'T GENERATE AN ASCII MODE CATN.
106025	E225 ASCII MODE	OBR DATA#2,3,16(OCTAL), 17 (OCTAL) OR 33 (OCTAL) GENERATED AN ILLEGAL ASCII MODE DAV.
106026	E226 ASCII MODE	OBR DATA=2 DIDN'T GENERATE AN ASCII MODE DAV.
106027	E227 ASCII MODE	OBR DATA=3 DIDN'T GENERATE AN ASCII MODE DAV.

Table 3-5. Error Information and Halt Codes (Continued)

HALT CODE	MESSAGE	COMMENTS
106030	E230 ASCII MODE	OBR DATA= 16(OCTAL) DIDNT'T GENERATE AN ASCII MODE DAV.
106031	E231 ASCII MODE	OBR DATA= 17 (OCTAL) DIDN'T GENERATE AN ASCII MODE DAV.
106032	E232 ASCII MODE	OBR DATA= 33 (OCTAL) DIDN'T GENERATE AN ASCII MODE DAV.
106033	E233 ORA FLAG	THE IBI WHILE TALKING TO ITSELF, DID NOT SET THE ORA FF.
106034	E234 IRL FLAG	THE IBI WHILE TALKING TO ITSELF, DID NOT SET THE IRL FF.
106035*	E235 HANDSHAKE	THE IBI, WHILE TALKING TO ITSELF, DID NOT TRANSFER PROPER DATA.
106036	E236 IRL FLAG	WITH LISTEN CLEAR, THE IBI DID AN ILLEGAL HANDSHAKE WHICH SET THE IRL FF.
106037	E237 ORA FLAG	WITH LISTEN CLEAR, THE IBI DID AN ILLEGAL HANDSHAKE WHICH SET THE ORA FF.
106040*	E240 HANDSHAKE	WITH LISTEN CLEAR, THE IBI DID AN ILLEGAL HANDSHAKE WHICH TRANSFERRED DATA.
106041*	E241 HANDSHAKE	WITH TALK CLEAR, THE IBI DID AN ILLEGAL HANDSHAKE WHICH TRANSFERRED DATA.
106042*	E242 REN	IB DATA BIT 8 LOW DRAGGED REN LOW ON IB.
106043	E243 DMA	DMA OUTREQFLG AND NDMARWSEL DID NOT GENERATE A DMA SRQ.
106044	E244 DMA	AN ILLEGAL DMA SRQ WAS GENERATED WITH NDMAOUTREQFLG HIGH AND IRLFLG LOW.
106045	E245 DMA	AN ILLEGAL DMA SRQ OCCURRED WITH NDMAOUTREQFLG HIGH AND DMARWSEL SET.
106046	E246 DMA	AN ILLEGAL DMA SRQ OCCURRED WITH IRLFLG SET, NDMARWSEL AND DMAOUTREQ-FLG.
106047	E247 DMA	IRLFLG AND DMARWSEL DIDN'T GENERATE A DMA SRQ.
106050	NONE	INFORMATION HALT. A CABLE TEST CANNOT BE EXECUTED WITH ONLY ONE IBI UNDER TEST. (CLEAR SWITCH REGISTER BIT 0 AND PRESS RUN TO CONTINUE).
106051	E251 CABLE	THE CABLING DID NOT TRANSMIT IFC.

Table 3-5. Error Information and Halt Codes (Continued)

HALT CODE	MESSAGE	COMMENTS
106052*	E252 CABLE	THE CABLING DID NOT TRANSMIT DATA OR THE HANDSHAKE SIGNALS (DAV, RFD, DAC) PROPERLY.
106053	E253 CABLE	THE CABLING DID NOT TRANSMIT REN.
106054	E254 CABLE	THE CABLING DID NOT TRANSMIT SRQ.
106055	E255 CABLE	THE CABLING DID NOT TRANSMIT ATN.
106056	H256 PRESS PRESET(s) AND RUN	INFORMATION HALT. PRESS PRESET(s) AND RUN.
106057	E257 PRESET DID NOT CLEAR IBI	PRESSING PRESET DIDN'T RESET THE IBI.
106060	E260 PP REQUEST	IBI FLAG NOT SET WITH PPLEX AND PPREQ HIGH.
106061	E261 PP REQUEST	IBI FLAG SET WITH PPLEX LOW. ATN, EOI HIGH AND ACTIVE LOW.
106062	E262 PP REQUEST	IBI FLAG SET WITH PPLEX LOW. ACTIVE, EOI HIGH AND ATN LOW.
106063	E263 PP REQUEST	IBI FLAG SET WITH PPLEX LOW. ATN, ACTIVE HIGH AND EOI LOW.
106064	E264 PP REQUEST	IBI FLAG SET WITH PPREQ LOW.
106067	NONE	SECONDARY HALT TO INITIAL ERROR HALT A-REG=CONTROL OR DATA WORD LAST OUTPUT TO IBI B-REG=SC UNDER TEST WHEN FAILURE OCCURRED.
106077	NONE	ILLEGAL TRAP CELL HALT. OPERATOR MAY FIND RETURN POINT FROM ILLEGAL INTER-RUPT IN THE P-REG.
NONE	PASS XXXXX	END OF PASS MESSAGE.

TALK ADDRESSES			DEVICE MY ADDR SWITCHES (A5-A1)
Octal	Decimal	ASCII Char	Octal
100	64	@	0
101	65	A	1
102	66	B	2
103	67	C	3
104	68	D	4
105	69	E	5
106	70	F	6
107	71	G	7
110	72	H	10
111	73	I	11
112	74	J	12
113	75	K	13
114	76	L	14
115	77	M	15
116	78	N	16
117	79	O	17
120	80	P	20
121	81	Q	21
122	82	R	22
123	83	S	23
124	84	T	24
125	85	U	25
126	86	V	26
127	87	W	27
130	88	X	30
131	89	Y	31
132	90	Z	32
133	91	[	33
134	92	\	34
135	93	]	35
136	94	^	36
137	95	_	

Used as UNTALK command only

LISTEN ADDRESSES			DEVICE MY ADDR SWITCHES (A5-A1)
Octal	Decimal	ASCII Char	Octal
40	32	SPACE	0
41	33	!	1
42	34	"	2
43	35	#	3
44	36	$	4
45	37	%	5
46	38	&	6
47	39	'	7
50	40	(	10
51	41	)	11
52	42	*	12
53	43	+	13
54	44	COMMA	14
55	45	-	15
56	46	.	16
57	47	/	17
60	48	0	20
61	49	1	21
62	50	2	22
63	51	3	23
64	52	4	24
65	53	5	25
66	54	6	26
67	55	7	27
70	56	8	30
71	57	9	31
72	58	:	32
73	59	;	33
74	60	<	34
75	61	=	35
76	62	>	36
77	63	?	

Used as UNLISTEN command only

UNIVERSAL COMMANDS			
Octal	Decimal	ASCII Char	Function
21	17	DC1	LLO Local Lockout
24	20	DC4	DCL Device Clear
25	21	NAK	PPU Parallel Poll Unconfigure
30	24	CAN	SPE Serial Poll Enable
31	25	EM	SPD Serial Poll Disable
ADDRESSED COMMANDS			
1	1	SOH	GTL Go to Local
4	4	EOT	SDC Selective Device Clear
5	5	ENQ	PPC Parallel Poll Configure
10	8	BS	GET Group Execute Trigger

CONTROL WORD TO IBI

GROUP 1

Octal	Decimal	ASCII Char	Function
1	1	SOH	IFC
2	2	STX	Local Command
3	3	ETX	REN
4	4	EOT	Deactivate Controller
5	5	ENQ	Activate Controller
6	6	ACK	Strobe Input Data
7	7	BEL	Initialize Flags

GROUP 2A

Used To Control Controller

Octal	Decimal	ASCII Char	Function
40	32	SPACE	Set Data Mode
50	40	(	Set EOI
60	48	0	Set ATN
70	56	8	Parallel Poll

GROUP 2B

Controls Talker/Listener Functions

Octal	Decimal	ASCII Char	Function
100	64	@	Disable Listen & Talk
110	72	H	Set Talk
120	80	P	Set Listen
130	88	X	Set Talk & Listen

GROUP 3

Mode Control

Octal	Decimal	ASCII Char	Function
600			ASCII Mode Enable
1200			SRQ Enable (If board is not controller)
2200			DMA Flag Select
4200			Packing Enable
10200			EOR Flag Enable
20200			OWRA Flag Enable
40200			IRL Flag Enable
100200			SPM Flag Enable (If Inactive Controller) IFC and SRQ Enable (If Active Controller)

STATUS WORD FORMAT

```
      FLAGS STATUS          BUS SIGNAL LINE        BUS FNCTN     PARALLEL POLL
                                 STATES              STATUS         PRIORITY
                                                                   ENCODE ID

 |  15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |

      I    I    O    E    D    N    N    R    A    L    T    A    P    P    P    P
      F    R    R    O    A    R    D    E    T    I    A    C    P    P    P    P
      C    L    A    R    V    F    A    N    N    S    L    T    I    I    I    I
                               D    C              T    K    I    D    D    D    D
                                                   E         V    3    2    1    0
                                                   N         E
```
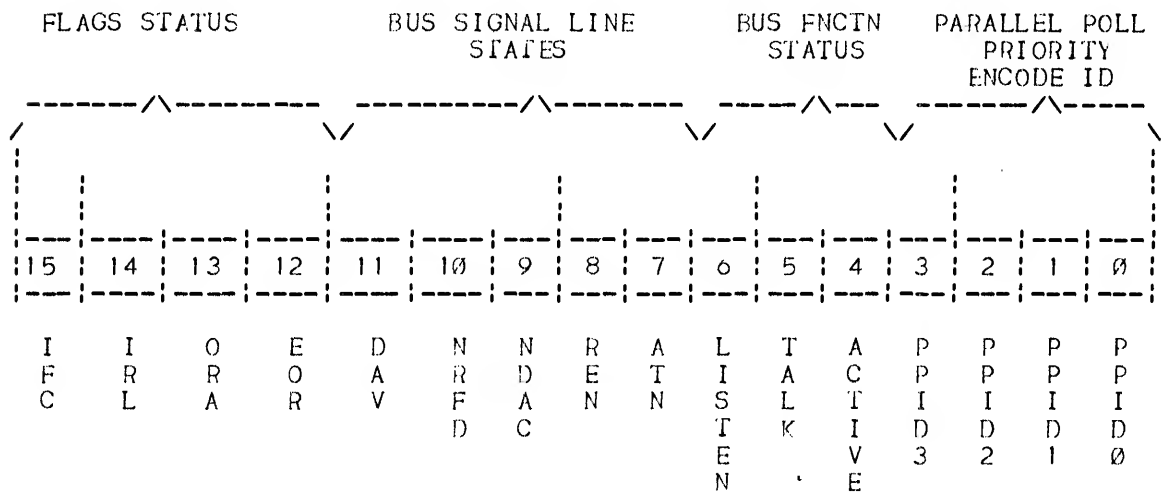
Note: Bit 4 is the status of the controller (active or inactive).